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ABSTRACT

Energy education has proliferated at two-year colleges in recent years. Most of the initial barriers to program development, including a shortage of expert advisors and instructors, a scarcity of established curricula and instructional resources, the delay between program conception and implementation, and difficulties in obtaining reliable manpower studies, have been resolved or reduced. Currently, about two-thirds of the 1,230 two-year colleges in the United States offer some form of energy education. Commonly, these programs share the following features: (1) most degree programs are broad based and their curricula are frequently multidisciplinary; (2) over one-half of the students in energy degree programs are interested only in specialty courses rather than in a degree; (3) the majority of non-degree and certificate programs focus on renewable energy resources and conservation; (4) credit and non-credit courses are offered in a range of college departments; (5) non-credit courses far outnumber credit offerings; (6) 1972 federal legislation resulted in the establishment of a large number of environmental degree programs; (7) other energy education activities have been sparked by tax incentive legislation and federal assistance; (8) most successful programs have developed community ties; (9) programs that dovetail with existing curricula are the most easily established; and (10) all substantial programs have been developed by small groups strongly committed to energy education. (HB)

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TWO-YEAR COLLEGE CONTRIBUTIONS

TO ENERGY EDUCATION

James R. Mahoney
Energy Communications Center
American Association of Community and Junior Colleges

July 1981

Presented at the First International Energy Education Conference
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TWO-YEAR COLLEGE CONTRIBUTIONS TO ENERGY EDUCATION

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From the 1977-78 to the 1979-80 academic years, the number of energy education degree and certificate programs offered in two-year colleges increased by 316 percent. The advance in credit and non-credit offerings was 420 percent. Currently, about two-thirds of the 1230 two-year community, junior, and technical colleges in this country offer some form of energy-related learning opportunity. This percentage represents about 825 institutions, with colleges in all 50 states offering programs.

These data are reported in Energy-Related Activities in Community, Junior, and Technical Colleges: A Directory (May 1981), produced by the American Association of Community and Junior Colleges' (AACJC) Energy Communications Center, a project funded by the U.S. Department of Energy. The Directory identified 1425 distinct programs at the colleges, including degree (two-year) and certificate (one-year) curricula, credit and non-credit courses or sequences of courses, workshops, seminars, applied research, consortia, and others. The figures were collected through a national investigation conducted over a year's time. Although the survey aimed at comprehensiveness, the compilers noted that a good deal more activity is carried on in the colleges than is reported in the document. The chart on the following page

displays the complete findings of the survey.

The expansion of energy-related programming in two-year colleges is best explained in the context of the philosophical purposes of the colleges. These low-cost, two-year institutions are founded on the principle of community service. Their target population, their central focus, falls on the citizens living in their prescribed geographical areas. Their primary responsibility is to provide educational opportunities for all people in their service districts consistent with their needs and interest. The confluence of this charge and the practical effects of the energy situation has moved the colleges to aggressively address energy learning.

Another reason for this impressive expansion involves the elimination of some of the barriers to program development that hindered the initial movement begun in 1973 at the time of the first energy crisis. These barriers included: scarcity of established curricula, paucity of resource documents, shortage of expert advisors who were familiar with both energy issues and community colleges, a limited number of trained instructors, and the general public belief that the liquid fuel crisis and attendant high costs were the result of collusion between oil companies and the federal government.

The complicated and demanding college process through which new programs must work before they are approved for implementation was a hindrance. One expert estimated, for example, that it takes approximately five years to take a program idea through to the first graduating class. The process includes a series of approvals from a variety

FIGURE I

*Energy-Related Programs in Two-Year Colleges and Technical Institutes

	PROGRAM FORM														
ENERGY FOCUS	DEGREE	DEGREE OPTION	CERTIF	CERTIF OPTION	CREDIT COURSES	CREDIT COURSE	NONCRDT COURSES	NONCRDT COURSE	SEMINARS	WORKSHOP	INFO CENTERS	RESEARCH DEVELOP	CONSORT	PLANNED PROGRAMS	TOTALS
Coal	21		4		11					1				3	40
Petroleum	13		3				1								17
Nuclear	17	1	1			3		1	3					1	27
Alternate	7	2	7		3	30	38	11	3	12	5	11	3	9	141
Appropriate Technology						1		1	1	2	4	1		2	12
Solar	30	22	25	6	64	111	20	55	6	11	2	12	2	10	376
Alcohol	1		2		1	2	3	2	1	50		7		9	78
Audit	1		2					21	5	5			2		36
Conservation	17	1	5		11	10	32	25	18	26	13	2	18	5	183
Awareness			1			1		1	2	4			1		10
Environmental	146		45		13	11	1	1	1				1	1	220
Energy-Gen.	4	2	1		9	8	26	5	9	8	8	3	8	12	103
Faculty Devel.										29					29
Facilities Conservation								-153-							-153
TOTALS	257	28	96	6	112	177	121	123	49	148	32	36	35	52	1425

*The totals at the bottom of each column represent discrete offerings, not discrete colleges. Some colleges, for example, offer more than one energy degree program or give several different kinds of seminars or provide multiple focuses through their information center. The 32 programs shown in the Information Centers column are offered by 23 institutions. The 35 institutions shown in the Consortium column are involved in 13 consortia.

From: Energy-Related Activities in Community, Junior, and Technical Colleges: A Directory.

of college committees, formal justifications, budget analyses, assessment of possible student audiences, and student recruitment.

Another serious handicap has been the difficulty in developing useful localized manpower studies. There are a number of reasons why these studies have caused problems. First, private and public organizations are generally unfamiliar with the services that, for example, an energy conservation manager might perform for them. They do not have job titles or position slots for such managers. Secondly, in many cases personnel offices often project manpower needs inadequately. Their main stress falls on immediate or short-term worker demands. Third, private sector firms, when they have projected manpower demands for short and long-term activities, are most often unwilling to share the information. Revealing it would provide their competition with evidence of their growth plans and would forewarn competitors of impending personnel searches that might affect their companies. The most such firms will reveal is gross numbers and unspecific job-descriptions, neither of which is useful to college planners for special education/training programs.

In the last few years many of these barriers have been reduced or eliminated. An increasing number of curricula and resource materials have been developed. With the growing experience of colleges in energy education, many experts exist in the colleges. While some residue of suspicion remains in the minds of the public regarding the causes of high energy costs, the majority of citizens believe that there is a genuine liquid fuel shortage. They believe that if they are going to

reduce the drain on their discretionary incomes caused by energy costs they need to learn a lot more about how they can conserve, and, in fact, how they might produce some of their own energy. The federal government has supported a variety of national faculty training programs, and a growing number of faculty in related disciplines have schooled themselves.

Manpower demand studies remain a problem. Some colleges have taken the initiative by attempting to show local firms that they need energy-trained workers and by demonstrating how such trained individuals might contribute to company income and reduce operating costs.

At least one national research center has consistently produced energy manpower studies over the last few years. Oak Ridge Associated Universities (ORAU) has prepared useful studies (generally through on-site investigations of operating industries) that focus on jobs projections, job categories, training required for each category, and most likely sources of training. While the ORAU studies are better than national reports that present gross figures, they tend to provide only regional pictures. The most useful studies for the colleges are local ones -- those that the colleges themselves have to apply. The ORAU studies offer effective models for local manpower investigations.

Additional characteristics of the college programs are:

1. Most of the degree programs are broad-based. They do not train narrowly-focused energy technologists who know only solar applications, alcohol fuel production, or conservation management, for example.

The curricula are frequently multi-disciplinary, involving coursework in the humanities, sciences/engineering, math, and general studies. Specialty courses are offered, but students emerge from the programs with skills that make them employable in a cluster of jobs, not just one job. They have, as a result, employment flexibility. The advantage of this kind of program is that while students are immediately employable in standard, existing positions such as laboratory technician, heating/ventilation/air conditioning (HVAC) technician, and construction tradesman, they are also capable of effectively advancing into new energy areas that their employers might develop. Their value is multiplied and their opportunities for advancement increased.

2. From one-half to two-thirds of the students taking courses offered in energy degree programs are interested only in the specialty courses, not in the degrees. Generally, younger students enter the programs with the intention of earning degrees. Older students are most often employed in related occupations and take the courses to prepare themselves for new company directions and career opportunities. One cause for this student distribution is the lack of a clear job market for narrowly trained energy technologists. Job markets tend to be scattered and regional.

3. The great majority of non-degree/certificate programs fall in the categories of renewable energy resources and conservation. Among the reasons for this tendency are: a) These resources are generally small-scale and low technology, suitable to community application. b) They are easily adaptable to individual use and can be developed

and applied in individual situations with a modest amount of training. Passive solar techniques, including greenhouses and sun control, for example, are not difficult to understand or apply. c) The courses focus on applications that have immediate results and pay for themselves within reasonable time-frames. d) They frequently reach for special audiences in the commercial world that spread the learning benefits to larger segments of the community through a ripple effect. e) They are focused on specific topic areas, fitted to student interest, and offered in short-term programs scheduled at times convenient to the target audience.

4. Credit and non-credit courses are offered in a range of college departments. But according to the recent AACJC survey, nearly 70 percent of the credit courses not offered as part of a specific energy degree or certificate are offered through the technology departments in the colleges. The greatest concentration of these courses is in the HVAC departments, and most of them focus on solar applications. The HVAC programs, in fact, hold nearly twice as many of these credit programs as does any other technology department. Physical science and engineering departments offer the second highest numbers of the credit courses.

The affiliation between the technologies and the energy credit programs is natural. Conservation and renewable energy applications frequently involve competence in sheetmetal, plumbing, electricity, construction, drafting, and engineering.

5. Non-credit courses far out-number credit offerings. Two facts

converge to explain this detail. Most citizens are interested in what they can do to reduce their personal energy costs. They are not interested in degrees or certificates, but rather in practical, short-term, hands-on experience that will help them caulk the holes through which their energy monies flow. And they are interested in learning state-of-the-art skills inexpensively. The colleges are expert adult educators, they often employ professionals or technicians from the community to teach courses, and they charge fees within the budgets of nearly every member of the community. On this last point, the average yearly tuition cost for public two-year colleges is $437, and typical average costs for non-credit, continuing education courses are between $25 and $35.

The largest percentage of non-credit programs is offered through adult and continuing education departments, or departments carrying similar responsibilities but under different titles. Examples are extended education opportunities, community service, and life long learning. More than 90 percent of the non-credit energy courses are presented through these departments. Many of them are short-term (as little as a few hours to several weeks spread out over the course of a quarter or a semester), narrow-focused learning. Examples are home weatherization, wood burning safety, home energy audits, passive and active solar systems, windmills, insulation, and ventilation. Special topic non-credit workshops or seminars, such as alcohol fuel production, are often presented through appropriate academic departments. In the case of alcohol fuel production seminars, for example,

many colleges provide the instruction through the agriculture department.

6. The large number of environmental degree programs (nearly 60 percent of the total reported in Figure 1, with 45 of them drinking water or wastewater treatment technology) was triggered by federal legislation passed in 1972. Since the passage of that legislation, the Environmental Protection Agency has spent more than $30 billion for community projects to establish wastewater treatment plants. In response to the anticipated need for trained technologists for these local plants, the colleges developed programs. Since the initial burst of programming (and the general national project shortcomings), little increase in the number of these degree curricula has occurred; in fact, in the last few years, some colleges have discontinued their programs.

7. As noted in (6) above, the U.S. Congress and federal government have stimulated a good bit of activity in the colleges. In addition to environmental programs, other energy education activities have been sparked by tax incentives legislation, Residential Conservation Service, schools and hospitals facilities conservation grants, emergency fuel assistance efforts, and research projects that have generated resource information useful in the classroom. Specific assistance has been made available to colleges through an assortment of national demonstration discretionary grants. These resources have provided colleges with national information centers, curriculum development assistance and access to curricula developed by other organizations, and lists of experts capable of providing technical assistance.

8. Most of the successful energy programs in the colleges have developed important ties with the communities. These ties are made in several ways. Four of them are: a) organizing a curriculum development committee composed of local energy firm employers to identify the specific skills graduates should possess for jobs; b) forming a curriculum advisory committee to review program directions, faculty appointments, achievements, and to help serve as placement resources for graduates; c) extending training opportunities to discrete audiences, including builders, realtors, architects, code administrators, engineers, and building managers; d) and developing cooperative agreements with local private sector organizations.

Cooperative agreements have a number of college advantages: student internships, paid work assignments for students that may also carry course credit, administrative fees for the college, equipment and services donated by the firms, and the potential, by example, of creating similar relationships with other enterprises. The advantages for the firms include the completion of company business for less than top wages and the opportunity to examine and select employees before they make hiring commitments. Colleges have developed cooperative agreements with local and regional utility companies, power firms, coal companies, nuclear plants, and trade associations. In a period when state and federal resources that have supported energy education development are being decimated, cooperative agreements will become even more significant for the colleges.

9. The programs most easily established in the colleges are those

that dovetail with existing curricula. HVAC has already been offered as an example of this arrangement, but other logical areas where energy focuses might be added with minimal difficulty are math, physics, chemistry, mechanical-electrical engineering, and building trades.

One final characteristic of these college programs needs to be noted. All of the more substantial college programs have been developed as a result of a small group (sometimes as small as two people) of college faculty and/or administrators (or a consortium of people from a collection of colleges) who were strong, outspoken advocates for energy education, who recognized the importance of the programs for students and the community, who understood early that the energy crisis was a long-term problem (a real one), and who believed that alternative, renewable sources of energy were available to local communities. They provided enthusiastic leadership for program development, without which the general conservatism of higher education might have delayed the introduction of such activities. These programs did not just happen. They happened essentially because of these cadres of people, many of whom practiced what they preached, building solar features in their own homes, applying conservation strategies at work and at home, attaching greenhouses to college buildings or to residential structures, constructing windmills in their yards, and working with local farmers to produce alcohol. In their efforts, they combined the theoretical with the practical. Without their involvement, the richness and comprehensiveness of the existing education opportunities would not have been achieved.

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